

# Treatment Outcomes of Open Pelvic Fractures Associated with Extensive Perineal Injuries

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**Background:** The main causes of death in patients with open pelviperineal injuries are uncontrollable bleeding and pelvic sepsis. The aim of this study was to evaluate the management outcomes of open pelvic fractures associated with extensive perineal injuries.

**Methods:** We retrospectively studied 15 cases with open pelvic fractures associated with extensive perineal injuries (urethral and anal canal laceration) admitted between August 2006 and September 2010. Mechanism of injury, Injury Severity Score, associated injuries, hemodynamic status on arrival, resuscitation and transfusion requirements, operative techniques, intra- and postoperative complications, length of intensive care unit and hospital stay, and mortality were recorded in a computerised database for further evaluation and analysis.

**Results:** The male to female ratio was 12:3 with an average age of 38.6 years (ranged, 11 to 65 years). The average packed red blood cell units used were 8 units (ranged, 4 to 21 units). All patients were initially transferred to the operating room for colostomy, radical debridement and fixation of the pelvic fracture by an external fixator. One patient had acute renal failure, which improved with medical treatment and 2 patients (13.3%) died, one with type III anteroposterior compression fracture due to hemorrhagic shock and the other due to septicemia.

**Conclusions:** Open pelvic fractures with extensive perineal injuries are associated with high mortality rates. Early diagnosis and appropriate treatment, including reanimation, colostomy, cystostomy, vigorous and repeated irrigation and debridement, and fixation by an external fixator can improve the outcomes and reduce the mortality rate.

**Keywords:** *Open fracture, Perineal injury, Pelvic fracture*

Pelvic fractures due to high-energy trauma are associated with life threatening injuries and high rates of mortality.<sup>1)</sup> Numerous studies have demonstrated that extensive blood loss is the main cause of death in patients with pelvic fractures.<sup>2-4)</sup> Type of the fracture according to Young-Burgess classification<sup>5)</sup> and presence of associated devastating soft tissue injuries affect transfusion requirement and mortality rate.<sup>3)</sup>

Despite advances taken to prevent accidents, initial resuscitation, intensive care management, and modern fracture stabilization techniques, the mortality rate of pelvic fractures is still high.<sup>6)</sup> Open fractures compared with closed fractures are associated with higher rates of morbidity and mortality and the latter approaches to 50% due to the additional risk of hemorrhage and multiple system organ failure.<sup>4,7)</sup> Risk factors that are commonly cited for mortality in peculiar fractures include an Injury Severity Score (ISS)<sup>8)</sup> of > 25, a triage-revised trauma score of < 8, > 65 years of age, < 100 mmHg initial systolic blood pressure, < 8 Glasgow Coma Scale (GCS), blood transfusion of > 10 units in the first 24 hours, and colloid infusion of > 6 L in the first 24 hours.<sup>9)</sup>

These fractures are more likely to need blood transfusion and be unstable vertically or rotationally.<sup>10)</sup> The

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important steps in dealing with open pelvic fractures are 1) control of bleeding, 2) proper treatment of soft tissue injury, which results in sepsis prevention, 3) identification and treatment of associated injuries, and 4) accurate fracture treatment.<sup>7,11)</sup> Patients with open pelvic fractures and associated soft tissue (especially perineal) injuries should be managed aggressively and promptly, because they are at highest risk of complications and death.<sup>11)</sup> Careful evaluation and management of the soft tissues also aids in appropriate technique selection necessary for treating underlying fracture.<sup>12)</sup> The aim of this study was to evaluate the management outcomes of these open pelvic fractures that are associated with extensive perineal injury.

## METHODS

From August 2006 and September 2010, 186 patients with pelvic fractures were referred to our trauma center. Of these, 15 cases with associated perineal injury were eligible to participate in this study. In the emergency department, all the patients were managed according to the standard Advanced Trauma Life Support (ATLS) protocol<sup>13)</sup> and antibiotics and anti-tetanus protocol were injected appropriately. Management course was different for each patient depending on his/her hemodynamic status.

### Hemodynamically Unstable Cases

In hemodynamically unstable cases, resuscitation and



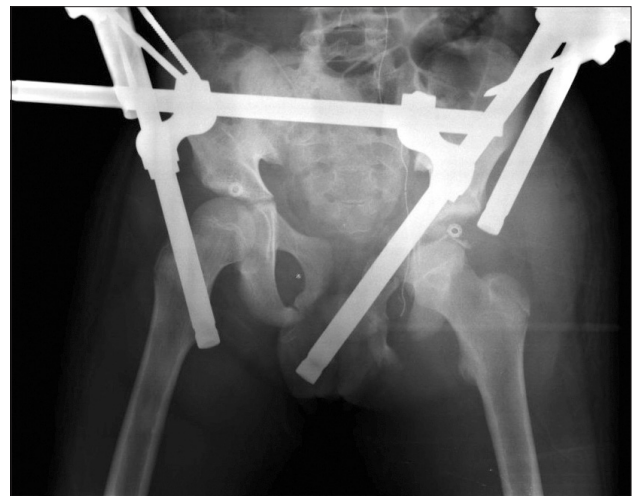
**Fig. 1.** An 18-year-old man motorcyclist had a head-on collision with a trailer. He had a type II anteroposterior compression open pelvic fracture with an associated extensive perineal injury and urethral tear, but focused abdominal sonography in trauma was negative. The patient underwent urgent perineal irrigation, debridement, cystostomy, and pelvic stabilization with external fixation device.

temporary pelvic stabilization were carried out initially. Stabilization was performed using a pelvic binder, an elastic bandage, or a circumferential bed sheet. Then, all of them underwent a thorough evaluation for any associated thoracic and abdominal injuries. Anteroposterior radiographs of the pelvis and chest and a lateral view of the cervical spine were routinely performed in these multiple injured patients (Fig. 1). Focused abdominal sonography in trauma (FAST) was also performed in all the patients as a part of the initial assessment. Patients with positive FAST results and failure to respond to medical treatment underwent urgent laparotomy and simultaneously perineal irrigation, debridement and colostomy associated with pelvic fixation by an external fixator device (Fig. 2). In those with urogenital injury, cystostomy was also performed.

### Hemodynamically Stable Cases

In hemodynamically stable cases, after clinical and imaging evaluation were completed, the patients were transferred to operation room for perineal irrigation, debridement, colostomy, and pelvic stabilization by an external fixator.

If necessary and the condition allowed, we added posterior fixation (plating or cannulated screw) to the routine external fixation device to achieve reliable stability. After surgery, in addition to standard anteroposterior radiography, inlet and outlet views of the pelvis, and a computerized tomography were also performed in all the patients. Demographic details, mechanism of injury, ISS, associated injuries, hemodynamic status on arrival, resus-



**Fig. 2.** Pelvic radiograph obtained after 31 days of hospitalization from the patient shown in Fig. 1. He underwent extensive debridement eight times. At the time of discharge, the cystostomy was closed and he was able to walk with the external fixator in place.

citation requirements, transfusion requirements, intra- and postoperative complications, length of intensive care unit stay, length of hospital stay and mortality were entered in a computerised database for further analysis. The mean follow-up period was 21.4 months (ranged, 12 to 131 months).

## RESULTS

Of the 15 patients, there were 12 men (80%) and 3 women (20%); their mean age was 38.6 years (range, 11 to 65 years). Ten patients were admitted within 6 hours after the accident while the rest were delayed up to 12 hours. The mechanisms of injury, No. of patients of pelvic fractures (according to Young-Burgess classification<sup>5)</sup>) and ISS in our patients were depicted in Table 1. The mean ISS in our patients was 29 (range, 11 to 61).

Injuries associated with these open pelvic fractures are depicted in Table 2. Two patients (13.3%) died; the first with a type III anteroposterior compression (APC) pel-

vis fracture was due to uncontrolled hemorrhagic shock, while the latter was due to septicaemia. We had one case with acute renal failure which improved with medical treatment. One patient (6.6%) had sciatic nerve palsy associated with type II lateral compression (LC) pelvis fracture. Five hemodynamically unstable patients (33%) underwent explorative laparotomy for suspected intra-abdominal injuries. All of these patients had intra-abdominal fluid based on FAST examination. Three of them had large expanding pelvic hematoma and two had spleen injury.

All the patients underwent colostomy (with sigmoid loop) and six patients (40%) underwent cystostomy due to urogenital injury. All hemodynamically stable and unstable patients had surgical stabilization of the pelvis within three hours from the arrival in the emergency department. In this procedure, we used an external fixator alone in 7 patients and an external fixator associated with a posterior fixation device (like plate or cannulated screw) in 8 patients.

Transfusions were required in all 15 patients. The average amount of blood transfused was 8 packed red blood cell units (range, 4 to 21 units). Two patients with APC type III fractures were in deep shock; one patient received 21 units of blood and survived but the latter received 18 units and postoperatively died due to his associated intra-abdominal injury. Thirteen patients (86.7%) received more than four liters of ringer lactate serum and 6 units of blood on the first day of admission.

Daily irrigation and debridement of the perineal wound were performed in all the patients. The mean

**Table 1.** Mechanism of Injury, No. of Patients of Fracture and Injury Severity Score

Index	No. of patients
Mechanism of injury	
Motor vehicle accident	10
Falling	4
Bicycle accident	1
Fracture type	
Lateral compression	
Type I	4
Type II	3
Type III	2
Anteroposterior compression	
Type I	0
Type II	3
Type III	3
Injury Severity Score	
10–19	2
20–39	4
40–59	5
60–75	4

**Table 2.** Injuries Associated with Open Pelvic Fractures

Associated injury	No. of patients (%)
Fractures in other extremities	
Femoral fracture	4 (26.7)
Tibial fracture	3 (20.0)
Elbow fracture	2 (13.3)
Knee fracture	2 (13.3)
Clavicular fracture	3 (20.0)
Spinal fracture	2 (13.3)
Rib fracture	4 (26.7)
Head injury	5 (38.5)
Abdominal injury	4 (26.7)
Hemothorax	2 (13.3)

length of stay in intensive care unit (ICU) and hospital were 7.4 days (range, 1 to 24 days) and 19.6 days (range, 8 to 36 days), respectively. In comparison to LC type, APC type fractures were associated with higher length of stay in hospital and ICU, and higher ISS. At the last follow-up visit, 12 patients (80%) with surgically treated unstable open pelvic fracture have returned to their original work without further significant disability, and only one patient changed his previous job.

## DISCUSSION

Open pelvic fractures are caused by high energy trauma and are commonly associated with many other injuries. These injuries often increase the rates of morbidity and mortality relative to closed ones. Literature reported mortality rates in open pelvic fractures varied up to 50%.<sup>4,7,10</sup> In our study, a defined resuscitation and pelvic fixation strategy initiated by a multidisciplinary approach team comprised of at least an orthopedic surgeon, a general surgeon, and an anesthesiologist resulted in better outcomes and less mortality rate of 13.3%.

Some authors have based their treatment protocol on the initial FAST, radiographic findings, and the presence or absence of hemodynamic shock.<sup>14</sup> Recently, it has been shown that immediate computerized tomography scanning in these multiple injured patients significantly accelerated proper diagnosis and targeted treatment interventions.<sup>1</sup>

Because of the high correlation between the mortality rate and initial hemodynamic status, we based our treatment protocol on the hemodynamic status.<sup>11,15</sup> It is often quoted that the amount of blood and serum transfusion has a direct correlation with the amount of organ injuries and the mean blood transfusion requirement is around 5 to 8 units in these pelvic fractures.<sup>16</sup> The rate is similar to our study (8 units).

APC type fractures compared with LC type or vertical shear, were found to have a higher risk of bleeding, while LC type fractures have the lowest. APC fractures also have a higher rate of mortality.<sup>2,4</sup> The results we obtained from this study also confirmed this.

Pelvic stability should be achieved immediately after injury because it has a vital role in the resuscitation of hemodynamically unstable patients.<sup>17</sup> Therefore, one of the first important measures in dealing with these open pelvic fractures is to fix the underlying cause of bleeding (from the chest, abdomen, or other sites) while simultaneously resuscitating the patient from shock by appropriate serum, blood elements, and electrolytes replacement.<sup>18</sup> Pelvic

bleeding control should be obtained by surgical exploration and/or early pelvic stabilisation. Early pelvic stabilisation has been shown to control bleeding and improve outcomes efficiently.<sup>19-21</sup> Emergency pelvic stabilization has led to increased survival after pelvic fracture.<sup>22</sup> Pelvic fixation by an external fixator device not only stabilizes the pelvis bones but also secures the tamponade effect of the haematoma in an ongoing venous bleeding place. Pelvic anti-shock clamp may also be used to stabilize posterior pelvic ring to limit pelvic ring expansion and control continuous bleeding.

Anterior external fixation is a useful technique easily applicable in urgent situations to reduce pelvic volume and control haemorrhage; however, proper anatomic reduction and stabilization of the posterior part of the pelvis may not be easily achieved by this and lead to chronic pain and long-term morbidity.<sup>19,20</sup> Early pelvic stabilization controls instability, decreases bleeding, diminishes risk of chronic pain and allows early patient mobilization. There are numerous techniques with variable success for pelvic fracture fixation including anterior plate stabilisation, posterior iliosacral screw or plate fixation and so on.<sup>23,24</sup> In this study we used an anterior external fixator with or without the posterior plating or screw fixation as soon as possible. Seven patients had anterior fixation alone with an external fixator while eight patients had combined anterior and posterior fixations.

The high probability of pelvic sepsis and multi-organ failure in open pelviperineal injuries has been frequently reported.<sup>25,26</sup> It has been noted that pelvic sepsis is associated with 21% mortality.<sup>26</sup> In these pelviperineal injuries, early fecal diversion (colostomy) with repeated aggressive irrigation and debridement have substantial preventive effects on pelvic sepsis,<sup>26</sup> although colostomy increases the length of hospitalization.<sup>27</sup> In the study we carried out, colostomy was performed in all the patients and we had three patients with pelvic infections and one sepsis and death. However, daily irrigation and debridement were done for all the patients.

One of the weaknesses of our study was the relatively small number of patients, but it should be mentioned that these severe orthopedic injuries are not so common. Therefore, careful evaluation and analysis of these potentially fatal injuries are important. Another drawback of our research was its retrospective nature. To provide more accurate recommendations we propose a stronger prospective study on a larger number of patients. In conclusion, open pelvic fractures with extensive perineal injury are associated with high mortality rate. Early diagnosis and appropriate treatment, including reanimation, colostomy,

cystostomy, vigorous and repeated irrigation and debridement, and fixation by an external fixator may improve the outcome and reduce the mortality rate.

## CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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